



SOME GEOLOGICAL AND HYDROLOGICAL DATA AT THE NAL SITE

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The secondary-hadron cascade initiated by proton losses can induce radioactivity in the soil surrounding the loss point. Natural ground water percolating through the activated regions leaches some of the radionuclides from the soil and transports them to new areas. The amount of shielding necessary to prevent contamination of ground waters depends on the exchange and transport of the radioactivity.

The following is a collection of geological and hydrological data obtained at the NAL site. These data and information from soil-leaching experiments¹ can be used to optimize efficient shielding design.

Soil borings have been made near the injection/extraction section of the main accelerator at NAL.² Results of these borings indicate that the stratum extending from ground level (~740 ft) to approximately 725 ft consists primarily of sand and silt. Below 725 ft, there lies a highly compacted mixture of fine granular sand, silt, and clay (glacial till) that extends down to 690 ft. The concrete floor of the synchrotron enclosures rests directly in this bed of glacial till. Beyond the 690 ft level, there is a 3- to 10-ft region of coarse gravel that is adjacent to the silurian dolomite aquifer.



In the top stratum of sand and silt, the vertical water flow velocity is about 3 ft/day.³ In the glacial till, the vertical velocity of flow is less than 10 ft/yr. Results from tracer measurements of vertical flow rates in the till range from 1 to 8 ft/yr with essentially no horizontal movement.

The water flow in the silurian aquifer has a significant horizontal component that depends on the water-level gradient. These gradients are on the order of 1 ft/mile. The estimated maximum horizontal flow is 13 ft/day with an average of 3-6 ft/day.⁴ Anomalies can occur due to hidden cracks in the bedrock.

REFERENCES

- ¹W. Fairman et al., The Extraction and Transport of Radionuclide in Soil Produced by High Energy Hadrons, National Accelerator Laboratory Internal Report TM-247, May 19, 1970.
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- ³M. R. McComas, Illinois State Geological Survey, Urbana, Illinois, private communication, August 8, 1969.
- ⁴R. T. Sasman and R. J. Schicht, Illinois State Water Survey, Naperville, Illinois, private communication, August 8, 1969.